

10/574651  
IAP20 Rec'd PCT/PTO 04 APR 2006

## DESCRIPTION

### Guide Apparatus

#### 5 Technical Field:

[0001] The present invention relates to a guide apparatus having a track rail and a moving block movably attached to the track rail with rolling elements interposed therebetween. More particularly, the present invention  
10 relates to a guide apparatus suitable for use in an environment where fine dust particles are flying.

#### Background Art:

[0002] There is a guide apparatus having, as shown in Fig. 1, a track rail 101 and a moving block 102 relatively  
15 movably attached to the track rail 101 with a multiplicity of rolling elements (balls or rollers) interposed therebetween (there are cases where the track rail 101 is fixed, and the moving block 102 is movable, and where the moving block 102 is fixed, and the track rail 101 is  
20 movable). In such a guide apparatus, the moving block 102 has a moving block body 103 mounted astride the track rail 101. End plates 104 are mounted astride the track rail 101 and secured to both ends of the moving block body 103 in the direction of relative movement. Seals 105 are mounted  
25 astride the track rail 101 and secured to the respective outer ends of the end plates 104 in the relative movement direction.

[0003] The seals 105 prevent foreign matter from entering

the moving block 102 through the gaps between the side surfaces of the track rail 101 and the inner peripheral surfaces of both ends of the moving block 102. Because the seals 105 are attached to the moving block 102, no or very  
5 small amount of foreign matter such as fine particles can enter the moving block 102 in an ordinary environment when the guide apparatus is used in such a manner that the track rail 101 is installed on a horizontal plane and the moving block 102 is attached to the horizontally extending  
10 track rail 101.

Disclosure of the Invention:

Problem to be Solved by the Invention:

[0004] When the guide apparatus is used in an ordinary environment and in the position as shown in Fig. 1, as  
15 stated above, entry of foreign matter into the moving block 102 will not give rise to a serious problem. The guide apparatus, however, may be used in the position shown in Fig. 2, where the track rail 101 is secured to a ceiling surface 106, and the moving block 102 is attached  
20 to the track rail 101 on the ceiling surface 106. In other words, the guide apparatus may be used in an inverted position. The guide apparatus may also be used in the position shown in Fig. 3, where the track rail 101 is horizontally secured to a wall surface 107, and the moving  
25 block 102 is attached to the horizontally extending track rail 101. That is, the guide apparatus may be used in a wall-hung position. As shown in Fig. 4, the guide apparatus may also be used in a position where the track

rail 101 is vertically secured to the wall surface 107,  
and the moving block 102 is attached to the vertically  
extending track rail 101. That is, the guide apparatus may  
be used in a vertical position. When the guide apparatus  
5 is used in any of these positions, particularly in an  
environment containing many dust particles, foreign matter  
is likely to enter the moving block 102 through the gaps  
between the side surfaces of the track rail 101 and the  
inner side surfaces of the moving block 102, thus  
10 preventing smooth rolling of the rolling elements (balls  
or rollers). This may cause a failure.

[0005] The present invention was made in view of the  
above-described circumstances. An object of the present  
invention is to provide a guide apparatus free from the  
15 possibility of foreign matter entering the moving block  
through the gaps between the side surfaces of the track  
rail and the inner side surfaces of the moving block even  
in an environment where many fine dust particles are  
flying.

20 Means for Solving the Problem:

[0006] To attain the above-described object, the present  
invention provides a guide apparatus including a track  
rail having rolling element rolling surfaces extending in  
the longitudinal direction thereof, and a moving block  
25 relatively movably attached to the track rail. The moving  
block has an approximately U-shaped sectional  
configuration in a plane perpendicular to the longitudinal  
direction of the track rail. The moving block has skirt

portions formed at both sides of the opening thereof and is mounted astride the track rail. The moving block includes a moving block body having load rolling element rolling surfaces that form load rolling element rolling passages in cooperation with the rolling element rolling surfaces. The moving block body further has rolling element relief bores associated with the load rolling element rolling surfaces. The moving block further includes end plates mounted astride the track rail and secured to both ends of the moving block body in the direction of relative movement of the moving block. The end plates each have rolling element direction change passages that form rolling element recirculation passages in cooperation with the load rolling element rolling passages and the rolling element relief bores. A plurality of rolling elements are disposed in the rolling element recirculation passages so as to recirculate in response to relative movement of the track rail and the moving block. The guide apparatus is characterized by including foreign matter entry preventing plates provided so that their respective distal ends longitudinally contact the opposite side surfaces of the track rail to close the gaps between the side surfaces of the track rail and at least the inner side surfaces of the skirt portions on both sides of the moving block body and the inner side surfaces of the end plates.

[0007] Thus, the guide apparatus is provided with foreign matter entry preventing plates having their respective

distal ends longitudinally contacting the opposite side surfaces of the track rail to close the gaps between the side surfaces of the track rail and at least the inner side surfaces of the skirt portions on both sides of the moving block body and the inner side surfaces of the end plates of the moving block. Therefore, there is no possibility of foreign matter, e.g. fine dust particles, entering through the gaps between the side surfaces of the track rail and the inner side surfaces of the skirt portions on both sides of the moving block body and the inner side surfaces of the end plates. This type of guide apparatus is generally provided with end foreign matter entry preventing devices at both ends of the moving block in the travel direction to prevent entry of foreign matter into the moving block through the gaps between the inner peripheral surfaces of both end portions of the moving block and the outer periphery of the track rail. Therefore, the gaps between the track rail and the moving block are closed by the end foreign matter entry preventing devices and the foreign matter entry preventing plates. Accordingly, it is possible to block foreign matter from entering the moving block substantially completely. Consequently, the plurality of rolling elements disposed in the rolling element recirculation passages of the guide apparatus can perform maintenance-free, smooth rolling for a long period of time.

[0008] In addition, the guide apparatus according to the present invention is characterized in that the moving

block has a plurality of attachment devices, including lubricators, mounted astride the track rail and secured to the outer ends of the end plates in the direction of relative movement. The foreign matter entry preventing  
5 plates also close the gaps between the side surfaces of the track rail and the inner side surfaces of the attachment devices.

[0009] Thus, the foreign matter entry preventing plates also close the gaps between the side surfaces of the track  
10 rail and the inner side surfaces of the attachment devices. Therefore, it is also possible to block foreign matter from entering the attachment devices.

[0010] In addition, the guide apparatus according to the present invention is characterized in that the foreign  
15 matter entry preventing plates are secured to the respective end surfaces of the skirt portions on both sides of the moving block body.

[0011] Thus, the foreign matter entry preventing plates are secured to the respective end surfaces of the skirt  
20 portions on both sides of the moving block body. Therefore, it is possible to install the foreign matter entry preventing plates easily using screws or the like while adjusting the contact pressure with the side surfaces of the track rail.

25 [0012] In addition, the guide apparatus according to the present invention is characterized in that the outermost ones of the plurality of attachment devices are metal scrapers formed from metal plates, and the longitudinal

end surfaces of the foreign matter entry preventing plates are secured to the metal scrapers.

[0013] Thus, the longitudinal end surfaces of the foreign matter entry preventing plates are secured to the metal scrapers. Therefore, the end portions of the foreign matter entry preventing plates are firmly secured. There is no possibility of the end portions of the foreign matter entry preventing plates vibrating or being displaced. When the gaps between the end surfaces of the two skirt portions of the moving block and the base surface to which the track rail is secured are narrow, the foreign matter entry preventing plates can be installed by inserting them from both end sides of the moving block. Thus, the installation operation is facilitated.

[0014] In addition, the guide apparatus according to the present invention is characterized in that the foreign matter entry preventing plates each comprise a plate-shaped foreign matter entry preventing plate casing made of a material of high rigidity, and a plate-shaped foreign matter entry preventing plate body made of a flexible material. The foreign matter entry preventing plate body is fitted to one side end portion of the foreign matter entry preventing plate casing, and one side end surface of the foreign matter entry preventing plate body is brought into contact with one side surface of the track rail.

[0015] Thus, the foreign matter entry preventing plates are each formed by fitting a plate-shaped foreign matter entry preventing plate body made of a flexible material to

one side end portion of a foreign matter entry preventing plate casing made of a material of high rigidity.

Therefore, the foreign matter entry preventing plates are simple in arrangement and easy to install.

5 [0016] In addition, the guide apparatus according to the present invention is characterized in that the foreign matter entry preventing plates each comprise a plate-shaped foreign matter entry preventing plate casing made of a material of high rigidity, a plate-shaped foreign  
10 matter entry preventing plate body made of a flexible material, and a foreign matter entry preventing plate retainer made of a material of high rigidity. The foreign matter entry preventing plate casing is secured to the end surface of one of the skirt portions on both sides of the  
15 moving block body in a state where one side end surface of the foreign matter entry preventing plate body is brought into contact with one side surface of the track rail and where the foreign matter entry preventing plate body is held between the foreign matter entry preventing plate  
20 retainer and the foreign matter entry preventing plate casing.

[0017] Thus, the foreign matter entry preventing plates are each installed in such a way that the foreign matter entry preventing plate casing is secured to the end  
25 surface of one of the skirt portions on both sides of the moving block body in a state where one side end surface of the foreign matter entry preventing plate body is brought into contact with one side surface of the track rail and



where the foreign matter entry preventing plate body is held between the foreign matter entry preventing plate retainer and the foreign matter entry preventing plate casing. Therefore, all the components constituting the  
5 foreign matter entry preventing plates have a simple plate-shaped configuration and hence become very easy to machine and less costly.

[0018] In addition, the guide apparatus according to the present invention is characterized in that the foreign  
10 matter entry preventing plates have their respective side end surfaces perpendicularly contacting the opposite side surfaces of the track rail.

[0019] Thus, the foreign matter entry preventing plates have their respective side end surfaces perpendicularly  
15 contacting the opposite side surfaces of the track rail. Therefore, entry of foreign matter can be prevented even more effectively.

[0020] In addition, the guide apparatus according to the present invention is characterized in that the foreign  
20 matter entry preventing plates have self-lubricating capability.

[0021] Thus, the foreign matter entry preventing plates have self-lubricating capability. Therefore, even if the side end surface of the foreign matter entry preventing  
25 plate body is brought into contact with the track rail side surface at a desired contact pressure, smooth relative movement of the track rail and the guide block is maintained.

### Best Mode for Carrying Out the Invention

[0022] An embodiment of the present invention will be explained below with reference to the accompanying drawings. Figs. 5 to 8 are diagrams showing the

5 arrangement of a guide apparatus according to the present invention, in which: Fig. 5 is an external perspective view; Fig. 6 is a sectional view taken along the line A-A in Fig. 5; Fig. 7 is a plan view of a moving block; and Fig. 8 is an exploded perspective view of the moving block.  
10 A track rail 11 is formed with a plurality (four in the illustrated example) of longitudinally extending rolling element rolling grooves 12-1 to 12-4 along which rolling elements (balls) roll.

[0023] A moving block 20 is movably attached to the track  
15 rail 11. The moving block 20 has a moving block body 21 and end plates 22 secured to both ends of the moving block body 21 in the travel direction of the moving block 20. Lubricators 23 are secured to the respective outer ends of the end plates 22 in the travel direction. End seals 24  
20 are secured to the respective outer ends of the lubricators 23 in the travel direction. Laminated contact scrapers 25 are secured to the respective outer ends of the end seals 24 in the travel direction. Metal scrapers 26 are secured to the respective outer ends of the  
25 laminated contact scrapers 25 in the travel direction.

[0024] The moving block body 21 has a U-shaped sectional configuration in a plane perpendicular to the longitudinal direction of the track rail 11. The moving block body 21

has skirt portions 28-1 and 28-2 formed at both sides of the opening thereof. The moving block body 21 is mounted astride the track rail 11. The moving block body 21 is formed with a plurality (four in the illustrated example) of load rolling element rolling grooves 27-1 to 27-4 that form load rolling element rolling passages 31-1 to 31-4 in cooperation with the rolling element rolling grooves 12-1 to 12-4 formed on the track rail 11. Further, the moving block body 21 is formed with rolling element relief bores 29-1 to 29-4, the number of which corresponds to the number of load rolling element rolling grooves 27-1 to 27-4.

[0025] The end plates 22 have a U-shaped sectional configuration in a plane perpendicular to the longitudinal direction of the track rail 11. The end plates 22 are mounted astride the track rail 11 and secured to both ends of the moving block body 21. The end plates 22 are formed with rolling element direction change passages 30-1 to 30-4, respectively. The rolling element direction change passages 30-1 communicate between the rolling element relief bore 29-1 and the load rolling element rolling passage 31-1, which is formed by the rolling element rolling groove 12-1 of the track rail 11 and the load rolling element rolling groove 27-1 of the moving block body 21, to form a rolling element recirculation passage. The rolling element direction change passages 30-2 communicate between the rolling element relief bore 29-2 and the load rolling element rolling passage 31-2, which

is formed by the rolling element rolling groove 12-2 of the track rail 11 and the load rolling element rolling groove 27-2 of the moving block body 21, to form a rolling element recirculation passage. The rolling element

5 direction change passages 30-3 communicate between the rolling element relief bore 29-3 and the load rolling element rolling passage 31-3, which is formed by the rolling element rolling groove 12-3 of the track rail 11 and the load rolling element rolling groove 27-3 of the

10 moving block body 21, to form a rolling element recirculation passage. The rolling element direction change passages 30-4 communicate between the rolling element relief bore 29-4 and the load rolling element rolling passage 31-4, which is formed by the rolling

15 element rolling groove 12-4 of the track rail 11 and the load rolling element rolling groove 27-4 of the moving block body 21, to form a rolling element recirculation passage. Rolling elements (balls) 32 recirculate through the rolling element recirculation passages in response to

20 the relative movement of the track rail 11 and the moving block 20.

[0026] The lubricators 23 supply lubricant to the rolling element rolling grooves 12-1 to 12-4 of the track rail 11. The lubricators 23 have a U-shaped sectional configuration

25 in a plane perpendicular to the longitudinal direction of the track rail 11. The lubricators 23 are mounted astride the track rail 11 and secured to the respective outer ends of the end plates 22 in the travel direction. The end

}

seals 24 prevent foreign matter adhering to the surface of the track rail 11 from entering the moving block 20. The end seals 24 have a U-shaped sectional configuration in a plane perpendicular to the longitudinal direction of the track rail 11. The end seals 24 are mounted astride the track rail 11 and secured to the respective outer ends of the lubricators 23 in the travel direction. The inner peripheral surfaces of the end seals 24 are in contact with the surface of the track rail 11.

[0027] The laminated contact scrapers 25 prevent minute foreign matter from entering the moving block 20. The laminated contact scrapers 25 have a U-shaped sectional configuration in a plane perpendicular to the longitudinal direction of the track rail 11. Each laminated contact scraper 25 has a plurality of felt-like plate materials laminated in the travel direction within a casing. The laminated contact scrapers 25 are mounted astride the track rail 11 with their inner peripheral surfaces being in contact with the surface of the track rail 11. In this state, the laminated contact scrapers 25 are secured to the respective outer ends of the end seals 24 in the travel direction. The metal scrapers 26 remove relatively large foreign objects such as chips, spatter and dust. The metal scrapers 26 have a U-shaped sectional configuration in a plane perpendicular to the longitudinal direction of the track rail 11. The metal scrapers 26 are mounted astride the track rail 11 with their inner peripheral surfaces being out of contact with the surface of the

track rail 11. In this state, the metal scrapers 26 are secured to the respective outer ends of the laminated contact scrapers 25 in the travel direction.

[0028] The end plates 22, the lubricators 23, the end seals 24, the laminated contact scrapers 25 and the metal scrapers 26 are stacked, respectively, and, in this state, secured to both ends of the moving block body 21 with screws 33.

[0029] Foreign matter entry preventing plates 34 are secured to the respective lower end surfaces of the skirt portions 28-1 and 28-2 (see Fig. 6) of the moving block body 21 with screws 35. The respective distal end surfaces of the foreign matter entry preventing plates 34 longitudinally contact the opposite side surfaces of the track rail 11 to close the gaps between the inner side surfaces of the moving block 20 and the side surfaces of the track rail 11, thereby preventing foreign matter such as fine dust particles from entering the inside through the gaps.

[0030] Fig. 9 is a diagram showing a structural example of the foreign matter entry preventing plates. Fig. 9A is a plan view, and Fig. 9B is an enlarged end side view. Each foreign matter entry preventing plate 34 comprises a foreign matter entry preventing plate body 36 and a foreign matter entry preventing plate casing 37. The foreign matter entry preventing plate body 36 is a plate-shaped member of continuous length made of a flexible resin material (e.g. urethane pad) or the like. The

foreign matter entry preventing plate casing 37 is a plate-shaped member made of a material of high rigidity, e.g. a resin or metal material, and has a U-shaped groove 38 formed in one side end surface thereof. One side end

5 portion of the foreign matter entry preventing plate body 36 is insertable into the U-shaped groove 38. A plurality (three in the illustrated example) of U-shaped grooves 40 for forming screw holes 39 are formed in one surface of the other side end portion of the foreign matter entry

10 preventing plate casing 37. Elliptic screw holes 39 are formed in the respective centers of the U-shaped grooves 40. Screw holes 42 are also formed in both end surfaces of the foreign matter entry preventing plate casing 37. The U-shaped grooves 40 each have such a depth that the head

15 of a screw 35 will not project from the surface of the foreign matter entry preventing plate casing 37 when the screw 35 is inserted into the associated screw hole 39.

[0031] One side end portion of the foreign matter entry preventing plate body 36 is inserted into the U-shaped

20 groove 38 of the foreign matter entry preventing plate casing 37 and bonded with an adhesive, thereby fitting the foreign matter entry preventing plate body 36 to the foreign matter entry preventing plate casing 37. The foreign matter entry preventing plate body 36 arranged as

25 stated above is secured to the end surface of one of the skirt portions 28-1 and 28-2 on both sides of the moving block body 21 with screws 35 (see Fig. 8) inserted into the screw holes 39. The foreign matter entry preventing

plate body 36 extends perpendicular to one side surface of the track rail 11, and one side end surface thereof is in contact with the side surface of the track rail 11 (see Fig. 6). At this time, the contact pressure of the one side end surface of the foreign matter entry preventing plate body 36 can be adjusted because the screw holes 39 are elliptical. More specifically, with the screws 35 untightened, the foreign matter entry preventing plate casing 37 is pressed toward the track rail 11, and after the pressing force has been adjusted, the screws 35 are tightened.

[0032] The foreign matter entry preventing plates 34 have such a length that they fit between the metal scrapers 26 at both ends of the moving block 20. Screws 44 are inserted into respective screw holes 43 (see Fig. 8) formed in the metal scrapers 26, and the distal end portions of the screws 44 are screwed into the screw holes 42 on the end surfaces of the foreign matter entry preventing plate casings 37 to secure the end surfaces of the foreign matter entry preventing plates 34 to the side surfaces of the metal scrapers 26. With this arrangement, there is no possibility of the end portions of the foreign matter entry preventing plates 34 vibrating or being displaced. When it is difficult to secure the foreign matter entry preventing plates 34 to the end surfaces of the skirt portions 28-1 and 28-2 on both sides of the moving block body 21 because the gaps between the end surfaces (lower end surfaces in Fig. 6) and the base



surface to which the track rail 11 is secured are small, the foreign matter entry preventing plates 34 can be installed by inserting them between the metal scrapers 26 and securing the foreign matter entry preventing plates 34 to the metal scrapers 26 with the screws 44 from both end surface sides of the moving block 20. The foreign matter entry preventing plate body 36 is formed by using a material impregnable with lubricant, e.g. urethane foam, and impregnating it with lubricant, thereby allowing the foreign matter entry preventing plate body 36 to have self-lubricating capability.

[0033] The foreign matter entry preventing plates 34 are arranged as stated above to close the gaps between the side surfaces of the track rail 11 and the inner side surfaces of the moving block 20, which comprises the moving block body 21, the end plates 22, the lubricators 23, the end seals 24, the laminated contact scrapers 25 and the metal scrapers 26, except the metal scrapers 26, which are attachment devices. Therefore, there is also no possibility of foreign matter entering the attachment devices, i.e. the lubricators 23, the end seals 24, and the laminated contact scrapers 25. Moreover, the end seals 24 and the laminated contact scrapers 25 prevent foreign matter from entering the moving block body 21 through the end portions thereof. Therefore, entry of foreign matter into the moving block 20 can be blocked substantially perfectly.

[0034] The guide apparatus arranged as stated above is

suitable for use in machines used in an environment where dust particles are flying, e.g. wood working machines in which wood chips or shavings are generated, cutting machines where plaster dust is generated, grinding

5 machines where grinding dust is generated, carpet cutting machines where fabric dust is generated, cleaning machines handling water and chemicals, machine tools where coolant is generated, and various outdoor machines where dust is generated.

10 [0035] Fig. 10 is a diagram showing another structural example of the foreign matter entry preventing plates.

Fig. 10A is an exploded perspective view, and Fig. 10B is an enlarged end side view. A foreign matter entry preventing plate 50 comprises a foreign matter entry

15 preventing plate casing 51, a foreign matter entry preventing plate body 52, and a foreign matter entry preventing plate retainer 53. The foreign matter entry preventing plate casing 51 is made of a material of high rigidity, e.g. a resin or metal material. The foreign

20 matter entry preventing plate casing 51 has stepped portions 54 and 55 formed in one surface of one side end portion thereof. The stepped portion 54 accommodates one side portion of the foreign matter entry preventing plate body 52. The stepped portion 55 accommodates one side

25 portion of the foreign matter entry preventing plate retainer 53. A plurality (three in the illustrated example) of U-shaped grooves 56 for forming screw holes 57 are formed in one surface of the other side end portion of

the foreign matter entry preventing plate casing 51 (i.e. the surface opposite to the surface formed with the stepped portions 54 and 55). Screw holes 57 are formed in the respective centers of the U-shaped grooves 56. Screw  
5 holes 58 are also formed in both end surfaces of the foreign matter entry preventing plate casing 51. The U-shaped grooves 56 have such a depth that the head of a screw 35 (see Fig. 8) will not project from the surface of the foreign matter entry preventing plate casing 51 when  
10 the screw 35 is inserted into the associated screw hole 57. [0036] The foreign matter entry preventing plate body 52 is a plate-shaped member of continuous length made of a flexible resin material (e.g. urethane pad) or the like. The foreign matter entry preventing plate retainer 53 is  
15 made of a material of high rigidity, e.g. a resin or metal material. As shown in Fig. 10B, one side portion of the foreign matter entry preventing plate body 52 is accommodated in the stepped portion 54 of the foreign matter entry preventing plate casing 51, and one side  
20 portion of the foreign matter entry preventing plate retainer 53 is accommodated in the stepped portion 55 of the foreign matter entry preventing plate casing 51, thereby holding the foreign matter entry preventing plate body 52 between the foreign matter entry preventing plate casing 51 and the foreign matter entry preventing plate  
25 retainer 53. The foreign matter entry preventing plate body 52 is positioned to extend perpendicular to one side surface of the track rail 11, and one side end surface

thereof is brought into contact with the side surface of the track rail 11. In this state, the foreign matter entry preventing plate casing 51 is secured to the end surface of one of the skirt portions 28-1 and 28-2 on both sides of the moving block body 21 with screws 35 inserted into the screw holes 57. The foreign matter entry preventing plate body 52 is formed by using a material impregnable with lubricant, e.g. urethane foam, and impregnating it with lubricant, thereby allowing the foreign matter entry preventing plate body 36 to have self-lubricating capability. The foreign matter entry preventing plate body 52 and the foreign matter entry preventing plate casing 51 are bonded together with an adhesive, and the foreign matter entry preventing plate body 52 and the foreign matter entry preventing plate retainer 53 are also bonded together with an adhesive. Screws 44 are inserted into the respective screw holes 43, which are formed in the metal scrapers 26, and screwed into the screw holes 58 on the end surfaces of the foreign matter entry preventing plate casings 51 to secure the end surfaces of the foreign matter entry preventing plates 50 to the side surfaces of the metal scrapers 26.

[0037] With the above-described arrangement, the components constituting the foreign matter entry preventing plate 50, i.e. the foreign matter entry preventing plate casing 51, the foreign matter entry preventing plate body 52, and the foreign matter entry preventing plate retainer 53, each have a plate-shaped

configuration and hence become easy to machine.

Particularly, it becomes unnecessary to perform machining to form the U-shaped groove 38 as provided in the foreign matter entry preventing plate casing 37 of thin wall

5 thickness, shown in Fig. 9, for inserting one side end portion of the foreign matter entry preventing plate body 36. Therefore, machining of the components becomes very easy, and costs are reduced. It should be noted that the operation and effect of the foreign matter entry  
10 preventing plate 50 are substantially the same as those of the foreign matter entry preventing plate 34 arranged as shown in Fig. 9.

[0038] The present invention is not necessarily limited to the above-described embodiments but can be modified in a  
15 variety of ways. For example, although the balls 32 are used as the rolling elements in the foregoing embodiments, the rolling elements are not necessarily limited to balls but may be rollers. Further, in the guide apparatus of the above-described embodiments, the track rail 11 is fixed,  
20 and the moving block 20 is movable. The arrangement may, however, be such that the moving block 20 is fixed, and the track rail 11 is movable. Regarding the use position also, the guide apparatus can be used in any position, e.g. an inverted, wall-hung or vertical position as shown in  
25 Figs. 2 to 4, besides the above-mentioned position.

#### Industrial Applicability:

[0039] As has been stated above, the present invention is a guide apparatus including a track rail having rolling

element rolling surfaces extending in the longitudinal direction thereof, and a moving block relatively movably attached to the track rail. The moving block has an approximately U-shaped sectional configuration in a plane perpendicular to the longitudinal direction of the track rail. The moving block has skirt portions formed at both sides of the opening thereof and is mounted astride the track rail. The moving block includes a moving block body having load rolling element rolling surfaces that form load rolling element rolling passages in cooperation with the rolling element rolling surfaces. The moving block body further has rolling element relief bores associated with the load rolling element rolling surfaces. The moving block further includes end plates mounted astride the track rail and secured to both ends of the moving block body in the direction of relative movement of the moving block. The end plates each have rolling element direction change passages that form rolling element recirculation passages in cooperation with the load rolling element rolling passages and the rolling element relief bores. A plurality of rolling elements are disposed in the rolling element recirculation passages so as to recirculate in response to relative movement of the track rail and the moving block. The guide apparatus is provided with foreign matter entry preventing plates having their respective distal ends longitudinally contacting the opposite side surfaces of the track rail to close the gaps between the side surfaces of the track rail and at least the inner

side surfaces of the skirt portions on both sides of the moving block body and the inner side surfaces of the end plates. Therefore, there is no possibility of foreign matter, e.g. fine dust particles, entering through the  
5 gaps between the side surfaces of the track rail and the inner side surfaces of the skirt portions on both sides of the moving block body and the inner side surfaces of the end plates. This type of guide apparatus is generally provided with end foreign matter entry preventing devices  
10 at both ends of the moving block in the travel direction to prevent entry of foreign matter into the moving block through the gaps between the inner peripheral surfaces of both end portions of the moving block and the outer periphery of the track rail. Therefore, the gaps between  
15 the track rail and the moving block are closed by the end foreign matter entry preventing devices and the foreign matter entry preventing plates. Accordingly, it is possible to block foreign matter from entering the moving block substantially completely. Consequently, the  
20 plurality of rolling elements disposed in the rolling element recirculation passages of the guide apparatus can perform maintenance-free, smooth rolling for a long period of time.

[0040] In the guide apparatus arranged as stated above,  
25 the moving block has a plurality of attachment devices, including lubricators, mounted astride the track rail and secured to the outer ends of the end plates in the direction of relative movement. The foreign matter entry

preventing plates also close the gaps between the side surfaces of the track rail and the inner side surfaces of the attachment devices. Therefore, it is also possible to block foreign matter from entering the attachment devices.

5 [0041] In the guide apparatus arranged as stated above, the foreign matter entry preventing plates are secured to the respective end surfaces of the skirt portions on both sides of the moving block body. Therefore, it is possible to install the foreign matter entry preventing plates

10 easily using screws or the like while adjusting the contact pressure with the side surfaces of the track rail.

[0042] In the guide apparatus arranged as stated above, the outermost ones of the plurality of attachment devices are metal scrapers formed from metal plates, and the  
15 longitudinal end surfaces of the foreign matter entry preventing plates are secured to the metal scrapers. Therefore, the end portions of the foreign matter entry preventing plates are firmly secured. There is no possibility of the end portions of the foreign matter  
20 entry preventing plates vibrating or being displaced. When the gaps between the end surfaces of the two skirt portions of the moving block and the base surface to which the track rail is secured are narrow, the foreign matter entry preventing plates can be installed by inserting them  
25 from both end sides of the moving block. Thus, the installation operation is facilitated.

[0043] In the guide apparatus arranged as stated above, the foreign matter entry preventing plates each comprise a



plate-shaped foreign matter entry preventing plate casing made of a material of high rigidity, and a plate-shaped foreign matter entry preventing plate body made of a flexible material. The foreign matter entry preventing

5 plate body is fitted to one side end portion of the foreign matter entry preventing plate casing, and one side end surface of the foreign matter entry preventing plate body is brought into contact with one side surface of the track rail. Therefore, the foreign matter entry preventing

10 plates are simple in arrangement and easy to install. [0044] In the guide apparatus arranged as stated above, the foreign matter entry preventing plates each comprise a plate-shaped foreign matter entry preventing plate casing made of a material of high rigidity, a plate-shaped

15 foreign matter entry preventing plate body made of a flexible material, and a foreign matter entry preventing plate retainer made of a material of high rigidity. The foreign matter entry preventing plate casing is secured to the end surface of one of the skirt portions on both sides

20 of the moving block body in a state where one side end surface of the foreign matter entry preventing plate body is brought into contact with one side surface of the track rail and where the foreign matter entry preventing plate body is held between the foreign matter entry preventing

25 plate retainer and the foreign matter entry preventing plate casing. Therefore, all the components constituting the foreign matter entry preventing plates have a simple plate-shaped configuration and hence become very easy to

machine and less costly.

[0045] In the guide apparatus arranged as stated above,  
the foreign matter entry preventing plates have their  
respective side end surfaces perpendicularly contacting  
5 the opposite side surfaces of the track rail. Therefore,  
entry of foreign matter can be prevented even more  
effectively.

[0046] In the guide apparatus arranged as stated above,  
the foreign matter entry preventing plates have self-  
10 lubricating capability. Therefore, even if the side end  
surface of the foreign matter entry preventing plate body  
is brought into contact with the track rail side surface  
at a desired contact pressure, smooth relative movement of  
the track rail and the guide block is maintained.

15 Brief Description of the Drawings:

[0047][Fig. 1] is an external perspective view showing a  
structural example of a guide apparatus.

[Fig. 2] is a diagram showing an example of the use  
position of a guide apparatus.

20 [Fig. 3] is a diagram showing an example of the use  
position of a guide apparatus.

[Fig. 4] is a diagram showing an example of the use  
position of a guide apparatus.

[Fig. 5] is an external perspective view showing a  
25 structural example of a guide apparatus according to the  
present invention.

[Fig. 6] is a sectional view as seen in the direction of  
arrows A-A in Fig. 5.

[Fig. 7] is a plan view showing a structural example of a moving block of the guide apparatus according to the present invention.

[Fig. 8] is an exploded perspective view of the moving  
5 block of the guide apparatus according to the present invention.

[Fig. 9] is a diagram showing a structural example of a foreign matter entry preventing plate of the guide apparatus according to the present invention.

10 [Fig. 10] is a diagram showing another structural example of a foreign matter entry preventing plate of the guide apparatus according to the present invention.

Explanation of Reference Numerals:

[0048] 11: track rail  
15 12: rolling element rolling groove  
20: moving block  
21: moving block body  
22: end plate  
23: lubricator  
20 24: end seal  
25: laminated contact scraper  
26: metal scraper  
27: load rolling element rolling groove  
28: skirt portion  
25 29: rolling element relief bore  
30: rolling element direction change passage  
31: load rolling element rolling passage  
32: rolling element (ball)

33: screw  
34: foreign matter entry preventing plate  
35: screw  
36: foreign matter entry preventing plate body  
5 37: foreign matter entry preventing plate casing  
38: U-shaped groove  
39: screw hole  
40: U-shaped groove  
42: screw hole  
10 50: foreign matter entry preventing plate  
51: foreign matter entry preventing plate casing  
52: foreign matter entry preventing plate body  
53: foreign matter entry preventing plate retainer  
54: stepped portion  
15 55: stepped portion  
56: U-shaped groove  
57: screw hole  
58: screw hole